**CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE**

**Faculty of Tropical AgriSciences**


# ASSESSING THE FACTORS INFLUENCING COMPLIANCE TO EUROPEAN UNION QUALITY STANDARDS OF GREEN BEANS IN KENYA

MASTER'S THESIS

Prague 2026

**Author**: Ing. David Oluwaponmile Fakayode

**Chief supervisor:** Ing. Petra Chaloupková, Ph.D., dr. h.c.

# Declaration

I hereby declare that I have done this thesis entitled “Assessing the Factors Influencing Compliance to European Union Quality Standards of green beans in Kenya” independently, all texts in this thesis are original, and all the sources have been quoted and acknowledged by means of complete references and according to Citation rules of the FTA.

In Prague date

.....

M.Sc. David Oluwaponmile Fakayode

# Acknowledgements

My gratitude first goes to God, the giver of life and everything good. I am a receipt of His extravagant grace and boundless love. I know I could not have come this far without him. Through his help, I smash the hardest bands and I vault the highest fences.

Throughout the writing of this research, I have received a great deal of support and assistance. I want to thank my supervisor, Ing. Petra Chaloupková, Ph.D., dr. h.c for her relentless and extremely valuable feedback throughout the duration of my work on this project; her expertise was particularly valuable in finalising the research topic, concept, and methodology. I would also like to thank Prof. Oliver Vivian Wasonga of the University of Nairobi, who provided insight and expertise that greatly assisted the research. Also, my on-site extension agent, Mr. Nelson, who provided the necessary support throughout my data collection.

I am incredibly grateful to my parents, Pastor and Mrs. Fakayode, for their love, prayers, care and sacrifice for educating and preparing me for the future. Also, to delectable siblings – Olumide, Wale, Charles and Daniel, your unconditional support and encouragement are greatly appreciated.

Finally, some friends were of great support in deliberating over our problems and findings, as well as providing a happy distraction to rest my mind outside of my research – Mataa, Oluwabunmi, Abyssinia, Gboluwaga, Gospel, Oluwafemi, Abdulmumeen, Enoch, Adetunji, and Olawale.

This research was funded by the Internal Grant Agency of the Faculty of Tropical Agri-Sciences, Czech University of Life Sciences Prague (IGA FTZ, Project No. 20243108)

# Abstract

Kenya’s green bean farming is a significant contributor to the country’s agricultural export economy, and compliance with European Union (EU) quality standards is a crucial factor in determining access to international markets. This study investigates the key factors influencing Kenyan farmers' adherence to these demanding standards, with a specific focus on social, economic, environmental, and regulatory dimensions. Guided by the Theory of Access, the research explores how differential access to capital, knowledge, authority, and social identity impacts the likelihood of certification among green bean producers. Using both quantitative and qualitative data collection methods, consisting of 194 farmers and 3 key informants. Probit regression analysis was used to analyse the factors influencing the possession of certification. The role of Frigoken, a major exporter and certification facilitator, emerges as a pivotal factor in bridging resource and knowledge gaps, offering targeted support to green bean farmers. The findings showed that the likelihood of certification possession was significantly influenced by gender and farmers' education level, as well as by access to extension services, land tenure security, access to technology, and access to credit. Contrary to prevailing assumptions, farm size and market distance were not statistically significant, suggesting that inclusivity and targeted interventions can enable even small-scale farmers to achieve certification. The findings advocated for gender-sensitive policies, enhanced extension services, and improved access to affordable credit, and investment in rural education and land security as key strategies for improving compliance rates. This research contributes to understanding sustainable agricultural practices in the context of global trade. By identifying critical enablers and barriers to certification, it offers practical insights for agribusiness stakeholders, policymakers, and development agencies seeking to enhance the competitiveness and inclusivity of Kenya’s green bean farming in the international market.



**Keywords**: Certification, market access, value-chain management, women empowerment.

# Content

# List of tables

# List of figures

# List of the abbreviations used in the thesis

| | |
|---|---|
| BRC | British Retail Consortium |
| CBI | Centre for Business Innovation |
| CDF | Cumulative Distribution Function |
| EC | European Commission |
| EU | European Union |
| FAO | Food and Agriculture Organisation |
| GAP | Good Agricultural Practices |
| GDP | Gross Domestic Product |
| GLOBALG.A.P | Global Good Agricultural Practices |
| IPPC | International Plant Protection Convention |
| ISO | International Standard Organisation |
| MRL | Maximum Residue Levels |
| NPPOs | National Plant Protection Organisations |
| OECD | Organisation for Economic Cooperation and Development |
| PHIS | Plant Health Inspectorate Service |
| QDA | Qualitative Data Analysis |
| SDGs | Sustainable Development Goals |
| UNEP | United Nations Environment Programme |
| USAID | United States Agency for International Development |

# 1. Introduction

Green beans, a major export crop, play a vital role in Kenya's agricultural economy, contributing significantly to employment and foreign exchange earnings. The European Union (EU) enforces stringent quality standards on agricultural imports, including green beans, to ensure consumer safety and product quality. These standards encompass aspects such as pesticide residue limits, physical condition and overall appearance. For Kenyan farmers, producers and exporters of green beans, meeting EU quality standards is crucial for accessing the European market. Green bean certification entails adherence to both product-specific standards and quality management systems, including the Global Good Agricultural Practices (GLOBALG.A.P.). Compliance requires investments in training, infrastructure, and production processes, with the emphasis laid on the importance of buoyant and sustainable agriculture and food systems by the Sustainable Development Goals (SDGs) (European Commission 2019).

To help farmers in Kenya navigate the EU's stringent requirements, Frigoken, a leading Kenyan green bean exporter, serves as a critical intermediary, bridging the gap between farmers and the EU and developing a framework accessible and understandable to farmers. Frigoken operates by integrating farmers into its supply chain, providing training on good agricultural practices, supplying inputs, and offering financial support to meet certification standards. The compliance process is complex and resource-intensive, requiring investments in infrastructure, training and certification. For farmers and exporters in Kenya, factors such as access to resources, knowledge of regulations and support from governmental and non-governmental organisations play a pivotal role in influencing compliance level. This approach not only ensures compliance with Frigoken standards, which align with EU regulations, but also contributes to the broader goals of women's empowerment and economic development in line with the SDGs. Frigoken has localised the EU requirements (Gwengi 2010).

However, male farmers are more frequently certified than their female counterparts. This disparity is attributed to differences in access to resources, training, and social networks among male and female farmers, reflecting broader gender inequalities in the agricultural sector. This gender gap in certification affects the achievement of the SDGs, particularly those focused on gender equality and empowerment (Meemken & Qaim 2018).

Despite Frigoken's well-structured support system, many farmers still fail to meet regulatory standards. In this context, this thesis assesses the economic, environmental, and social factors influencing EU quality standards for green beans in Kenya. The findings of this

research can help identify areas for improvement, optimise performance, and increase competitiveness. It can also provide insights that can guide stakeholders in improving compliance rates, enhancing market access, and fostering more sustainable and inclusive green bean farming in Kenya.

# 2. Literature Review

## 2.1. EU Quality Standards

The EU plays a dominant role in setting global benchmarks for agricultural trade, particularly for green beans. Given the EU's emphasis on food safety, environmental sustainability, and consumer protection, its quality standards have become a reference point for producers and exporters worldwide. These standards influence production systems in both developed and developing countries, pushing toward harmonisation of agricultural practices, improved traceability, and stricter control of inputs. Thus, farmers and exporters seeking to access the lucrative European market must understand and comply with these regulations. While the standards aim to ensure the safety and quality of imported produce, they also reflect a broader political economy of trade, in which regulatory compliance can serve both as a gateway and a gatekeeper (European Commission 2019).

Green beans for export to the EU market must meet general marketing standards as stipulated in Regulation EU No. 543/2011, in alignment with international norms such as UNECE FFV-18. These standards specify the physical characteristics of green beans – cleanliness, uniformity, freedom from defects and proper sizing – as well as the packaging and labelling requirements needed to ensure transparency and traceability. In addition to visual and physical quality, the EU enforces strict sanitary and phytosanitary measures. Green beans are monitored for potential phytosanitary risks, such as quarantine pests, and must be accompanied by phytosanitary certificates from the exporting country (Okello et al. 2011).

Concerns among consumers, particularly in Europe, have led to increased focus on food safety and security. As such, developed countries have implemented strict regulations on pesticide residue limits and food packaging hygiene to prevent food safety issues and alleviate consumer concerns. Kenyan green beans are exported to a highly regulated, pesticide-sensitive market. Maintaining high-quality standards is crucial to meeting sanitary and phytosanitary regulations (Freidberg 2003).

Green beans must satisfy several legal and non-legal technical quality requirements before they can be exported to the EU market. Maximum residue levels (MRLs) for pesticides and contaminants, traceability, product integrity, conformance to specifications, labelling, and packaging, as well as pod size, specifications, and packaging, are among the legal requirements.

Social and environmental compliance is addressed by the non-legal requirements. Also, the exporter must adhere to the following specifications: the length must be between 8 and 10 cm, and the diameter must be between 4 and 6 mm. The colour must be mid to dark green, with a tolerance of 0–5% for rust and 0–5% for anthracnose.

More specifically, the following requirements relate to the several green bean grades for the European market.

**Table 1: Green Bean grades for the EU market**

| Grades | Length (cm) | Diameter (mm) | Turgidity | Colour | Curvature | Disease/Pest tolerance |
|---|---|---|---|---|---|---|
| Extra fine | 8 – 10 | 4 – 6 | <5% flaccid | mid-dark green | Straight/hardly curved | 0 – 5% anthracnose, 0 – 5% rust |
| Fine | 10 – 17 | 6 – 9 | <5% flaccid | light green | Straight/slender curved | <5% anthracnose, <5% rust |
| Bobby | 14 – 17 | 8 – 10 | <5% firm & crisp | mid-dark green | Straight/slightly curved | <5% anthracnose, <5% rust |

Source: Infonet Biovision 2014.

In response to the EU's strict standards, Frigoken has developed a comprehensive approach to ensure compliance throughout its supply chain. The company operates an extensive scheme that collaborates with numerous farmers across Kenya. To meet EU requirements, Frigoken requires that all participating farmers adhere to Good Agricultural Practices (GAP), including the use of approved pesticides, the maintenance of detailed production records, and the implementation of proper hygiene measures. This adherence is formalised in alignment with EU standards. Frigoken supports its farmers by providing essential inputs, including seeds and fertilisers. Additionally, the company offers extension services to educate farmers on compliance with international standards. The costs of these inputs are later deducted from the total earnings upon product delivery. This integrated support system not only facilitates compliance with EU standards but also enhances the productivity and livelihoods of farmers involved (Okello et al. 2007).

Frigoken Limited exemplifies how Kenyan farmers and exporters can navigate the complex landscape of EU quality standards through strategic partnerships with farmers and a commitment to GAP.

## 2.2. Green Beans Certification

Green bean certification is essential to ensure that green beans meet specific safety, quality, and sustainability standards and to facilitate access to international markets. For the production and export of green beans, certification is pertinent. Obtaining certification is a prerequisite for exporting to EU markets, as it requires adherence to protocols on pesticide use, the maintenance of detailed farm records, and the proper hygiene during harvesting and post-harvest handling. Achieving this certification can be resource-intensive, posing challenges for farmers (Muriithi et al. 2011).

Certification for green beans destined for the EU market is a process that verifies compliance with both statutory and private standards governing food safety, environmental sustainability and quality assurance. Within the EU regulatory framework, certification is not merely an administrative requirement; it is a critical determinant of market access, trade community and consumer trust. For countries such as Kenya, where green bean exports constitute a significant share of trade, EU certification presents both opportunities and challenges. The certification process for green beans begins with compliance with the EU's core regulations. These regulations collectively require that green beans entering the EU market be safe for consumption, free of harmful pesticide levels, traceable throughout the value chain, and subject to monitoring and verification by accredited authorities (Lengai et al. 2022).

In Kenya, the certification process is supported by institutions such as the Plant Health Inspectorate Service (PHIS), which conducts phytosanitary inspections and issues export certificates. PHIS operates in accordance with the International Plant Protection Convention (IPPC) and ensures that green beans comply with the EU’s phytosanitary regulations prior to shipment. This also confirms that shipments are free of pests and diseases and comply with plant health regulations. Phytosanitary certification is a cornerstone of safe and compliant trade in green beans. It encompasses a combination of regulatory oversight, farmer education and international cooperation, which makes the green bean export achievable and sustainable

While the certification process provides access to high-value markets, the dynamic nature of EU regulations, with periodic adjustments to pesticide maximum residue limits (MRLs) and quality parameters, demands continuous adherence and adaptation, which may not be feasible without sustained institutional support. The role of intermediaries, such as Frigoken, is critical in this context. By providing training, supplying compliant inputs, and ensuring post-harvest quality control, Frigoken enables farmers to meet EU certification standards. Frigoken helps streamline the certification process by aggregating produce from farmers, standardising production practices, and ensuring compliance throughout the supply chain. (Jaffee et al. 2011).

Frigoken's quality control measures and certification processes have been examined in several studies. A study by Jaffee and Masakure (2005) found that Frigoken's adoption of EU quality standards, such as ISO 22000 and ISO 9001, had improved the quality of their exports. The study also noted that Frigoken's quality control measures had increased the EU's confidence in Kenyan exports.

Frigoken holds certifications such as the BRC (British Retail Consortium) certificate and ISO (International Standard Organisation) 22000:2015, demonstrating their commitment to quality and food safety. They also ensure that the exporting farmer adheres to good agricultural practices to cultivate crops safely, cleanly, and responsibly. It emphasises food safety alongside environmental, labour, and product quality standards, and is regarded as a minimum standard by importers, retailers, and the majority of European supermarkets. Implementing Frigoken standards requires significant investments in technology and upgrades by producers. Farmers in developing nations, such as Kenya, often lack financial resources and may rely on loans or other sources of funding to make investments. Non-compliance with these standards will prevent smallholder farmers in Kenya from accessing the European market and generating revenue through employment (Henson 2008).

In addition to this requirement, compliance with MRLs is required, which are the regulatory limits for pesticide residues or contaminants in food and feed. The EU has established MRLs for pesticides in food to minimise health and environmental concerns. This certificate is crucial for EU exporters, as it demonstrates that farmers use appropriate pesticides and herbicides in cultivating green beans. Pesticide residues in food should be minimal and safe for consumers (Okello et al. 2011).

In general, certifications attest that the consignment has been exported, inspected, complies with EU requirements, is free of pests, and has been treated and packed in accordance with the stipulated standards.

## 2.3 Benefits of Green Bean Certification

Green bean certification is a key component in ensuring that agricultural exports meet international standards for safety, quality, and environmental sustainability. Globally, certification enables access to high-value markets and enhances the competitiveness of agricultural products. For Kenya, certification is significant in opening export avenues and providing a pathway for farmers to engage in global trade. This section discusses the benefits of certification and how these benefits are localised within Kenya.

### 2.3.1 Global Perspective

i. Market access and trade expansion: Certification systems such as GLOBALG.A.P. are widely recognised by international buyers, especially in the EU markets. These standards help farmers access high-value markets that demand compliance with rigorous food safety, environmental and labour standards (Henson et al. 2011).

ii. Improved product quality and consumer confidence: Certification enhances product quality by establishing guidelines and best practices for production. Adhering to these standards, farmers are encouraged to improve their farming methods, reduce the use of harmful pesticides, and implement environmentally friendly practices. This results in higher-quality green beans, thereby enhancing consumer confidence in the product's safety and sustainability (Jones et al. 2024).

iii. Sustainable practices and environmental benefits: Globally, certification systems often incorporate elements of sustainability by promoting environmentally friendly agricultural practices. For example, adherence to EU standards ensures that farmers employ sustainable practices. These practices not only protect the environment but also safeguard the long-term viability of farming as an economic activity. Through certification, farmers contribute to a

sustainable food system that aligns with growing global demand for environmentally friendly products (Otieno et al., 2017).

### 2.3.2 Kenya Perspective (The Role of Frigoken)

i. Access to international market: For Kenyan green bean producers, certification provides a gateway to EU markets, which remain one of the largest markets for Kenyan exports. Frigoken plays a crucial role in supporting farmers by offering technical assistance, training and input supply. This ensures that farmers meet the required certification standards and the EU's phytosanitary requirements. Without such support, farmers struggle to meet these standards independently due to resource and knowledge constraints (Jaffee et al. 2011).

ii. Economic Growth and Fair: Beyond market access, certification also creates opportunities for economic growth and fair trade for farmers. Frigoken's intervention involves aggregating produce from multiple farmers, providing them with a secure market, and facilitating higher incomes through certified exports (Ochieng et al. 2017). Through certifications, farmers can get higher prices for their produce, which ultimately improves their livelihoods and financial sustainability (Muriithi et al. 2011).

iii. Environmental sustainability and nature-positive future: Frigoken's certification systems also emphasise environmental sustainability, ensuring that Kenyan farmers adopt practices that improve environmental sustainability. Farmers participating in Frigoken's programs are encouraged to use Integrated Pest Management (IPM) techniques and to adopt crop rotation and soil conservation practices. These practices are essential for envisioning a nature-positive future, ensuring that farming remains viable in the long term and aligns with sustainability goals (UNEP 2021).

As demand for certified, high-quality produce grows, Frigoken's role in facilitating certification becomes increasingly important in securing Kenya's position in the global agricultural export market.

## 2.4 Agriculture in Kenya

Kenya's economy relies heavily on agriculture, which has significant development potential. Also, it plays a vital role in Kenya's economy, serving as the backbone of the nation and supporting the livelihoods of the majority of Kenyans. According to the Kenya National Bureau of Statistics, the agricultural sector accounted for 31.3% of the country's Gross Domestic Product (GDP), with an additional 27% coming from the manufacturing, distribution, and service sectors. It also accounts for nearly 70% of export earnings and employs over 80% of the rural labour force (FAO 2014, OECD 2019).

The agricultural sector differs in a variety of production systems that exhibit varying levels of resilience, productivity, and efficiency. These are classified as extensive, semi-intensive, or intensive, based on agro-ecological zones, including climate (temperature, rainfall, etc.), soil (type, fertility, and water-holding capacity), and topography (slope, elevation, aspect). The agricultural sector includes three sub-sectors, namely crops, livestock, and fisheries, and it has a large number of stakeholders because of its economic significance and rural focus, which affects many people's livelihoods. According to the Ministry of Agriculture, Livestock, Fisheries and Cooperatives (2021), industrial crops, such as tea, coffee, sugarcane, cotton, tobacco, sisal, and coconut, account for up to 70% of agricultural exports, which significantly contribute to the economy. Food crops account for 32% of the agricultural GDP and 0.5% of export earnings, while the horticulture sector contributes up to 24% to the gross domestic product (OECD 2019).

In Kenya, the agricultural sector accounts for 65% of export earnings, provides livelihoods (employment, income, and food security) for more than 80% of the population, and contributes to improved nutrition through the production of safe, diverse, and nutrient-dense foods. The non-agricultural sector/economy is also the main driving force, providing inputs and markets for non-agricultural activities such as construction, transportation, tourism, education, and other social services. Given the centrality of agriculture to rural Kenya, where poverty is prevalent, the sector's role in poverty alleviation cannot be overstated. Strengthening and improving the performance of the agricultural sector and enabling the engagement of the poorest and most vulnerable in this process are therefore prerequisites for achieving recovery and growth in Kenya after recent years of drought and slow development.

Kenya's food crops are divided into cereals, pulses, and roots & tubers. Kenya has two growing seasons, and most crops are intercropped. Rainfall occurs in two seasons: long from March to May and short from October to November (Ministry of Agriculture 2021). In addition, Kenya's horticulture subsector has become a significant foreign-exchange earner, an employment contributor, and a contributor to food security. The main vegetable export crops include kale, cabbage, tomatoes, indigenous vegetables, garden beans, onions, carrots, and green beans.

A large proportion of Kenyan farmers primarily engage in subsistence farming, with only a minority participating in full commercial farming. Despite continuous population growth, agriculture has largely been subsistence-oriented, and productivity has remained stagnant in recent years. Only 20% of Kenyan land is suitable for farming, and maximum yields have yet to be realised. This presents a significant opportunity to boost production. Furthermore, agriculture is characterised by the dominance of raw products, which hinders the creation of employment opportunities and fails to capitalise on higher-value commodities and manufacturing (USAID 2022).

Also, some of the risks facing Kenya's agriculture industry include frequent, severe droughts, a heavy reliance on rain fed agriculture, and high rates of poverty among smallholder farmers and pastoralists Also, the low capacity of extension workers, lack of investments and capital to agricultural activities, pests and diseases, inadequate access to credit, and limited use of technology in agriculture prevent the growth of Kenya's agricultural sector (D'Alessandro et al. 2015).

## 2.5 Green Beans Farming

Green beans (Phaseolus vulgaris) are among the most significant fresh vegetables produced in developing nations, and numerous African countries have focused on exporting them to high-value European markets. Historically, small and medium-scale farmers in Africa have mainly produced green beans for export (Okello et al. 2007).

Green beans are very perishable due to their high moisture content and early harvesting. As a legume pod, the green bean's skin is very delicate and can be easily damaged, producing bruises and cuts that may catalyse further decomposition. Green beans are susceptible to moisture loss and dehydration due to their thin skin, high moisture content (about 85%), and

rapid respiration rates (FAO 2018). After harvest, green beans should be kept at 10-15 degrees Celsius to ensure a 2–4-week shelf life. Exposure to high temperatures or intense sunlight can adversely affect bean quality (Fulano et al. 2021).

Green bean production requires extensive physical labour, including harvesting, planting, irrigation, weeding, chemical spraying, and fertiliser application. Green beans are grown in various regions of Kenya, with the main production areas being the Rift Valley, Central, and Eastern provinces. The majority of beans are grown in the Mount Kenya Region. In particular, the three counties of Kirinyaga, Murang'a, and Meru contribute approximately 80% of the green beans produced by smallholder farmers (Fulano et al. 2021).

The crop thrives in temperate climates with well-drained soils (KALRO 2019). Popular green bean varieties in Kenya include Kentucky Wonder, Blue Lake, and Snapbush. These varieties are suitable for different market requirements, including export and local consumption. Also, Irrigation is essential for green bean production in Kenya, particularly during dry seasons. Drip irrigation and sprinkler systems are commonly used to conserve water and reduce labour costs (FAO 2014).

Green bean farming in Kenya is an important agricultural activity that provides livelihoods for many smallholder farmers. While there are challenges like pests, diseases, climate change, and market fluctuations, there are also opportunities for growth, value addition, and sustainable agriculture. Kenya produces two varieties of green beans: one for fresh export, exported to the European market, sold in supermarkets, supplied to restaurants and other food service providers, and the other for processing; canned for long-term preservation, blanched, packed, sealed, and heat-treated, then exported to global markets (Okello et al. 2007).

### 2.5.1 Fresh Export Green Beans

For fresh bean export, the varieties grown include Belle Campo, Vanilla, Samantha, Serengeti, Boston, Star, Soria, and Lomami. Fresh export yields of beans range from about 6,000 kg to 10,000 kg per hectare (KALRO 2019). This depends on whether the beans came from scattered farms, mechanised, large-scale farms, or smallholder farms with ties to export companies through contracts and extension services. Fresh bean exports range from produce loosely packed to beans that have undergone significant value addition. The post-harvest process is carried out in packhouses, where produce is added value before export. The processes

include cleaning, sorting, grading, trimming, weighing, packing, and cooling. Specifically, packhouses that specialise in the processing and export of vegetables depend on a consistent supply of green beans from October to May, or even year-round. Packhouse operators depend on hired labourers for these tasks; a medium-sized operator may employ 50 people, while a large-scale operator may employ 300 people (Ngutu et al. 2018).

A field supply team is typically responsible for motivating farmers to produce for medium- to large-scale packhouse operators. This supply team may comprise technical assistants (TAs) stationed in farming areas and accountable to an agronomist at the company's headquarters. They frequently manage the provision of extension services, coordinate with collection teams, and supply essential production inputs, such as seed. This entails the coordination of a preliminary round of sorting at the collection facility, as well as the arrangement of harvesting operations with farmers (Fulano et al. 2021).

Kenya’s green bean export sector also creates hidden environmental, health, and social costs primarily from water use, emissions, low incomes, and child labour that total about $124 million, far exceeding its market and export value, highlighting major sustainability concerns (Odhiambo et al. 2026).

Fresh bean exports range from loosely packed produce to beans that have undergone substantial value addition, including sorting, trimming, packaging in small units on trays or punnets, weighing, and packing. The export of both fresh and processed green beans entails substantial post-harvest losses, including beans rejected for export and wastage, estimated at 42% for the fresh beans value chain and 30% for the processed beans value chain. The beans rejected for export are mainly used for three different purposes, namely:

(a) Domestic consumption in Kenya by households, restaurant and hotel customers, or institutional buyers such as schools.

(b) Use of green beans as animal feed, whereby livestock keepers obtain beans from farmers or packhouses after sorting of the produce; and

(c) Beans used as compost in that those beans that have not been harvested or sorted out in the field are ploughed into the field.

Kenya’s fresh green bean export industry is a significant sector, with the country among the leading exporters of fresh green beans. However, specific challenges in exporting fresh green beans are summarised below (Fulano et al. 2021).

- **Phytosanitary and Technical Quality issues**: Fresh green beans exported to the EU market must comply with stringent phytosanitary (health of plants) and technical quality standards. Non-compliance can result in rejection of the shipment.
- **Pest and Disease Management**: Green beans are susceptible to pests like aphids, whiteflies, and spider mites, as well as diseases like powdery mildew and rust. Effective pest and disease management is crucial to meet the export standards.

### 2.5.2 Canned Green Beans

Canned green beans are primarily produced in Kenya's Rift Valley, Central, and Eastern provinces, where the crop thrives in temperate climates with well-drained soils. The varieties of green beans grown for canning are Goal, Source, Catarina, Caledonia and Sagana. Bean yields for the canning industry range from 10,000 to 12,500 kg per hectare (KALRO 2019). Compared with exports of fresh green beans, activities for canned produce exports are minimal. Activities in a processing factory include receiving produce, sorting, washing, blanching, quality control, canning in cans or jars, and storage before shipment.

Specifically, the following stages are involved in the processing of canned beans, which vary depending on the product (CBI 2022).

1. **Post-harvest activities** include cleaning and shelling pods, pruning (for green beans), washing, and sizing the crop. These tasks are typically completed using specialised machinery, and cleaning beans often involves water and air jets.
2. **Soaking and blanching** soften beans and eliminate gases, which improves taste. Before being canned, beans are blanched, a process that involves rapidly heating them after soaking them in a salt solution.
3. **Canning and packaging** entail filling and sealing cans of beans. Aluminium cans are the most widely used packaging type, although jars, cartons, and pouches are also common.
4. The next stage of processing is **adding brine to cans**. Though there are no hard-and-fast guidelines for this ratio, cans often contain equal amounts of beans and brine,

depending on the recipe used. Typically, brine is made of salt and water, occasionally with additional ingredients such as sauces, meat, sugar, and spices.

5. **Seaming** is the technique of sealing a cylindrical container with a lid.
6. **Sterilisation** and extremely high cooking temperatures ensure that beans are cooked and stored using sterilisation and extremely high cooking temperatures.
7. The final steps include **labelling, cooling, and storage**. Cans are cooled in water before being stacked and palletised for storage in warehouses. Labels must comply with the buyer's requests and European legal requirements.

In addition, exporters require Green bean produce with a specified size (neither too large nor too small), insect-free, and a specific shape. Beans are shipped by air to Europe and packaged in boxes with extra-fine and fine grades. Both the yield per hectare and the ratio of the two grades vary with the harvest frequency. The beans are not only gathered and delivered but also cut, washed, combined into multi-product packs, labelled, and bar-coded (Muriithi 2008).

## 2.6 Green Bean Value Chain

The EU is a significant market for green beans, with stringent quality and safety standards. Depending on the season, it is estimated that the EU green bean supply chain employs between 45,000 and 60,000 people and supports 50,000 small-scale farmers (Munga et al. 2021).

The green bean value chain, like other horticultural value chains, comprises a diverse set of players, including farmers, dealers, packhouses, canning factories, and transportation and freight companies. Producers are often grouped into groups and regulated by contractual agreements with exporters. The demand for green beans in the EU is relatively high and stable, driven by consumer preference for high-quality, sustainably produced beans. The EU green bean value chain originates from both within the EU and from countries outside the EU, particularly in Africa. In Africa, Kenya is a major supplier of green beans to the EU, particularly for fresh and prepared beans. This is due to the country’s favourable climate, which enables year-round production, experienced farmers and exporters, and efficient air freight infrastructure for the rapid transport of fresh green beans to European markets. Generally, the

Kenyan green bean value chain primarily involves farmers producing the majority of green beans, which are then collected by traders, sorted and packaged in packhouses, and then exported to EU markets, with most value addition occurring at the export level due to the perishable nature of the crop and limited local demand, leaving farmers with a smaller share of the profit; key actors include farmers, collectors, traders, packhouses, exporters and sometimes local retailers with limited access to high-quality green beans. In Kenya's green bean value chain, smallholder farmers dominate production, with most green beans exported to EU markets, where large exporters play a significant role. Key value chain dynamics include reliance on family labour, limited local market demand due to perishability, challenges with quality control and market access, and a need for better training to optimise production and pricing power across the value chain (Munga et al. 2021).

Below is the (general) value chain overview for Kenya Green bean production:

i. **Input Stage:** This includes seed supply, local and international seed companies, fertilisers and chemicals, farm labour (smallholder farmers and contract farmers), irrigation and equipment.
ii. **Production Stage**: This includes land preparation, planting and maintenance, pest and disease management.
iii. **Processing Stage:** This includes sorting and grading, trimming and cleaning, packaging and canning.
iv. **Distribution Stage:** Transportation, storage, and logistics.
v. **Marketing and Sales Stage**: Export marketing, local marketing, and price negotiation.
vi. **End-User Stage:** Export market, local market, consumer preferences

In the EU market system, value chain addition primarily occurs through two types of post-harvest handling operations: processing canned beans and packaging fresh beans. These activities take place in packhouses and canning plants, respectively. Value-adding processes carried out in packhouses include cleaning, sorting, grading, trimming, weighing, packing, and cooling of produce. Trade is conducted mainly through three channels: contractual agreements, brokers/intermediaries, and domestic wholesalers/retailers (Munga et al. 2021). The green bean value chain is mainly influenced by European retail stores, which set pricing and quality requirements (USAID 2015).

As a key player in the agricultural sector, green bean farmers play a crucial role in meeting the demands of both domestic and international markets. Effective participation in the

Green Bean Value Chain requires farmers to undertake a range of activities, from seed selection and land preparation to harvesting, grading and marketing. By understanding the various roles that green bean farmers play in the Value Chain, the challenges and opportunities they face can be appreciated, and strategies to support their success can be identified. Here is a specific outline of the roles of green bean farmers in the value chain:

- **Seed selection and procurement**: Farmers select and purchase high-quality green bean seeds suitable for their region and market demands.
- **Land preparation and planting**: Prepare land, plant seeds, and manage their green bean crops to ensure optimal growth.
- **Input procurement**: Farmers purchase necessary inputs like seeds, fertilizers, and equipment to support their green bean production.
- **Crop management**: Farmers apply fertilizers, pesticides and irrigation as needed to maintain healthy green bean plants
- **Pest and disease management**: They monitor the crops and take action to prevent or control pest and disease outbreaks.
- **Harvesting**: Farmers carefully hand-pick or mechanically harvest green beans at the optimal stage of maturity.
- **Grading and packing**: Farmers (also with the help of quality control personnel) sort and pack green beans according to quality, size and colour to meet market requirements.
- **Marketing and sales**: They market and sell their green beans to exporters, wholesalers and processors.

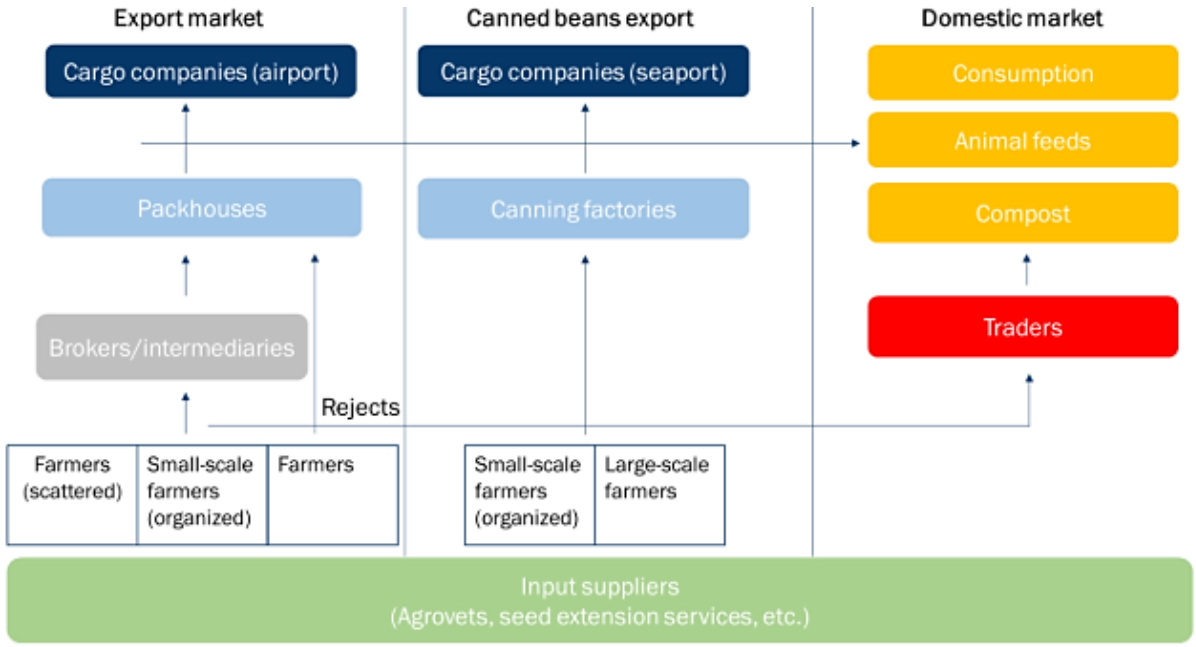



**Figure 1:** Market players in the Green Bean value chain

**Source**: Odero et al. 2013

Several significant challenges limit the further development and expansion of the green bean value chain in Kenya. First, exporters face challenges due to limited technical and managerial competence among producers, particularly in non-traditional bean-producing areas, which leads to higher supervision and service costs. Contract violations and side-selling, such as crop poaching and brokering, are also common (Ngutu et al. 2018).

Furthermore, inadequate transportation infrastructure in agricultural locations hinders the timely collection and delivery of fresh food. Most collecting centres lack cold-storage facilities, and manufacturing in remote locations requires refrigerated trucks, which are more expensive to operate. Finally, Kenyan packaging costs more per unit than competitors. Therefore, despite Kenya's past success in Green bean exports, the increasingly strict rules that exporters to the EU market must adhere to have made the future of the Green bean value chain uncertain, especially for smallholder farmers (USAID 2015). By analysing these value chains, stakeholders in Kenya's green bean farming industry can better understand the complex

interactions and relationships within them and how they can be maximised to comply with EU quality standards.

However, the key factor in disease and pest tolerance is the specific green bean variety planted. Breeders continually work to develop new varieties with improved resistance. Additionally, appropriate growing conditions (soil, irrigation, and air circulation) can significantly enhance each variety's resistance to diseases and pests.

Also, retailers in the European market and other countries have developed private standards. For instance, farmers who export green beans must comply with Frigoken standards (formerly known as Spiceken EPZ). Frigoken Ltd., a food safety standard for fresh produce, was established in 1989. Smallholder farmers adhere to Frigoken standards through exporter-farmer or group-based partnerships. Frigoken works closely with small-scale farmers in Kenya, providing them with technical support, training and market access. This partnership enables farmers to improve their agricultural practices, increase their yields and earn better income (Gwengi 2010).

## 2.7 Factors Influencing the EU Quality Standard of Green Beans in Kenya

The EU quality standards for certification of agricultural imports, including green beans, emphasise food safety, environmental sustainability, and ethical production. Kenya, a major supplier of green beans to the EU, faces several challenges in meeting these standards. These challenges are shaped by economic, social, and environmental factors that directly affect the production, handling, and export of green beans (Okello et al. 2007).

Meeting EU quality standards involves a significant financial investment. This includes costs for certification, the upgrading of farming practices, and the implementation of traceability systems. Smallholder farmers, who dominate Kenya's green bean production, often struggle to meet these standards, thereby limiting their access to EU markets. These standards are not merely technical barriers; they reflect broader global concerns about health, fairness, and environmental stewardship. For Kenya, aligning its green bean production with EU requirements involves navigating a complex web of economic, social, and environmental factors. These dynamics shape the production processes, influence the livelihoods of smallholder farmers, and impact the sustainability of agricultural practices. Understanding the

interplay of these forces is critical to ensuring Kenya remains a competitive and reliable supplier to the EU market.

**Table 2: Factors influencing compliance to EU quality Standards of Green Bean**

| Factors | Items | | |
|---|---|---|---|
| **Economic Factors** | ***Credit Access:*** For Kenyan farmers to meet EU standards, they need capital investments | ***Land Access:*** Access to land is essential to produce green beans that meet EU specifications. | ***Farm Machinery Access:*** EU standards often require the use of efficient farm machinery. |
| | ***Pesticide Access:*** The EU has strict regulations on pesticide residues in agricultural produce. | ***Market Access:*** Farmers need Infrastructure, such as transport and storage facilities, to access both local and international markets. | ***Market Price:*** The price of green beans, EU quality standards. |
| | ***Fertiliser Access: Fertilisers*** are critical to achieving high yields and crop quality. | ***Land Access:*** The availability and security of land tenure are vital for farmers to invest in long-term improvements. | ***Labour Access:*** Green bean farming requires skilled labour for planting, maintaining, and harvesting. |
| **Social Factors** | ***Information Access:*** Access to reliable and up-to-date information is crucial for Kenyan farmers to meet EU standards for green beans | ***Certification:*** *T*o export green beans to the EU, Kenyan farmers must obtain certifications, such as the Frigoken certification. | ***Farming Experience:*** The more experienced farmers are, the better they are at understanding and adapting to EU standards |
| | ***Friends' Assistance:*** Support, particularly from fellow farmers, helps individuals adopt best practices for green bean production | ***Extension Service:*** Government and NGO extension services are vital in assisting farmers | ***Group Membership:*** Being part of a farmer's group or cooperative significantly influences a farmer's ability to meet EU standards |
| **Environmental Factors** | ***Rainfall Adequacy & Duration:*** Adequate and well-distributed rainfall is essential for optimal growth, yield, and quality | ***Drought Frequency:*** Frequent droughts, especially in key production areas, reduce water availability for irrigation | ***Increased Temperature:*** Rising temperatures, driven by climate change, negatively affect green bean production. |
| | ***Disease Incidence:*** The spread of fungal and bacterial diseases affects the yield of green beans | ***Pest Outbreaks:*** Pests are a significant concern for green bean farmers. | ***Pesticide Price:*** EU-approved pesticides are relatively expensive. |

Source: Lengai et al. (2022)

# 3. Aims of the Thesis

This thesis explores local farmers compliance with EU quality standards for green beans in Kenya, with a focus on Frigoken's certification process as the only official certification authority. In view of this, this research seeks to provide an in-depth understanding of the current state of green bean value chain, challenges of local farmers in fulfilling the requirements set by EU, and the role of certification in ensuring compliance with EU quality standards.

The overall objective of the study is to examine the factors influencing adherence to the quality standards requirements of green bean production in Kenya. Specifically, the study aims to:

i. Identify and analyze gender-based differences in the degree of compliance with green bean quality standards among local farmers.
ii. Compare certified and non-certified farmers from an economic, social, and environmental perspective.
iii. Examine the key factors that influence farmers' capacity to comply with certification requirements in green bean production.

Farmers without certification are restricted to selling their produce in the national market, where prices are generally lower, and opportunities for sustainable trade contracts are limited. In contrast, certified farmers benefit from higher income opportunities, access to premium markets, and long-term export contracts, which collectively enhance their financial sustainability. In pursuit of the above aims, this thesis seeks to identify the challenges and key aspects which could support the local farmers to fulfil the quality standard criteria of the EU, identify areas for improvement in relation to information flow, and provide recommendations to enhance the competitiveness of Kenyan green bean exports in the EU market.

Therefore, the following hypotheses were tested:

$H_1$ Male farmers are more likely to be certified for green beans export (Ali et al. 2019).

$H_2$ Farmers with access to extension agents are more likely to be certified for green bean export (Malimi 2023).

$H_3$ Farmers with higher levels of education are more likely to be certified for green bean export (Chelang'a et al. 2023).

$H_4$ Farmers with larger farm sizes are more likely to be certified for green bean export (Asfaw et al. 2009).

# 4. Methodology

## 4.1 Theoretical Framework

The Theory of Access describes how arrangements of bundles of powers and private property rights influence who has access to resources and how that access is acquired, preserved, and managed. This theory distinguishes between the ability to gain from resources and the right to access them. Individuals may possess the right to access a specific resource, but they may not necessarily be able to utilise the resource productively to derive benefits from it. This is due to a lack of structural and relational mechanisms, including technology, capital, market access, labour, knowledge, authority, social identity and social relations (Ribot et al. 2003). This theory provides a comprehensive framework for analysing the role of access in meeting EU quality standards.

The primary objective of this thesis is to identify the key factors that enable farmers to comply with international quality standards, guided by the selected factors described by the Theory of Access. Generally, *access to capital* - measured in Euros - is the ability to access wealth through finance and equipment (also discussed under technology) that can be utilised for extraction, production, conversion, labour mobilisation, and other processes associated with extracting benefits from things and people. For this study, access to capital is considered expressed by farm income. One way to keep up resource access is to have credit or access to finance, in terms of *market access*, the market's distance – measured in kilometres (km) (to and fro the farm) was considered a proxy indicator of the geographical location of the farm.

*Access to knowledge* is vital in shaping who can benefit from resources. It includes three fundamental aspects: practical experience (age), formal education (years of schooling), and knowledge gained from experts (extension services). *Access to authority* shapes an individual's ability to benefit from resources. This privileged access to individuals or institutions can strongly influence who benefits from a given resource. In this research, access to extension agents was considered as a proxy of access to authority.

*Access to social identity* is often mediated by social identity, including membership in communities or groups, such as those defined by age, gender, ethnicity, religion, status, profession, place of birth, shared education, or other attributes that constitute social identity. This is evaluated as participation in different membership groups.

## 4.2 Conceptual Framework

Several factors affect the quality standards for green bean production. In this study, the decision to comply with these standards is a function of demographic, economic, social, and environmental factors. Demographic factors such as age, gender, farming experience, education (Njoba et al. 2016), farm size and household size (Nthambi et al. 2013), and off-farm income (Muriithi 2008) may influence adoption or compliance with quality standards.

Economic factors such as access to credit and inputs such as seeds, herbicides, and fertilisers (Muriithi 2008, Elosy & Mburu 2012); and access to markets (Njoba et al. 2016), and farm income (Nthambi et al. 2013) can affect the quality standards of the produce. Also, social factors that may influence quality standards include access to information and training, contact with extension agents and contract farming (Njoba et al. 2016; Chelang'a et al. 2023), and group membership (Muriithi 2008; Nthambi et al. 2013); and assistance from friends and family in the form of gifts and remittances (Njoba et al. 2016). Thus, a green bean farmer who joins a group is likely to have greater access to information from an export firm, which may result in higher-quality produce. Additionally, close contact with extension agents is likely to improve the adoption of international quality standards by enhancing understanding of the requirements for export production. Environmental factors, including rainfall, drought, flood, diseases and pests (Otieno et al. 2017); and access to irrigation (Asfaw et al. 2009) may affect compliance with the quality standards for green beans in Kenya. These variables impact compliance and access to global markets, thereby lowering transaction costs and promoting sustainable livelihoods.

## 4.3 Data Collection Approach

To assess the EU quality standards and regulations governing the production and export of green beans in Kenya, a quantitative questionnaire survey was used as the primary data collection method. Data were collected from various stakeholders, as described in the following chapter, ranging from farmers engaged in agricultural practices to exporters who process and package products. A multi-stage sampling method was used with a sample size of 220 households from selected green bean-growing counties.

Cochran's formula was used to ensure statistical validity and representativeness of green bean farmers in Kiambu, and Murang'a counties, with a total population of 500 farmers. Cochran's formula for sample size calculation is given by:

$$n_0 = \frac{Z^2 p(1-p)}{e^2}$$

where:

- Z = 1.96 (for a 95% confidence level),
- P = 0.5 (assuming maximum variability in the population),
- e = 0.05 (5% margin of error).

This ensures an optimal balance between statistical precision and practical feasibility in data collection while maintaining a 95% confidence level and a 5% margin of error. The sample size of 220 comfortably exceeds this criterion, with the minimum being 218, ensuring the statistical precision is accurate and reliable.

## Study Area

The Central Region of Kenya, comprising counties such as Nyeri, Kirinyaga, Murang'a, Kiambu, and Embu, purposively selected, is a significant area for the cultivation of green beans owing to its favourable climate, with well-defined wet and dry seasons, fertile volcanic soils with good drainage and aeration promoting healthy root development and nutrient uptake, and well-developed farming practices. This region is predominantly inhabited by the Kikuyu ethnic group, who have a rich cultural heritage and a strong presence in Kenya's socio-economic landscape (Beatious 2024).

The combined population of these counties is approximately 5.45 million. This region is predominantly Christian, according to the 2019 census data. The religious affiliation in these counties is Protestants (40%), Catholics (30%), other Christian denominations (20%), Muslims and other religions (<10%) (KPHC 2019).

Kiambu and Murang'a counties are selected as the study area for this research is informed by their prominence in green bean production, attributed to their high population of approximately 3.5 million, favourable climate and soil conditions. Specifically, both counties exhibit a climate conducive to green bean cultivation. Also, the counties' fertile soils with good

drainage and aeration, which support healthy plant growth and optimal yields, proximity to urban centres and export markets enable farmers to engage in commercial green bean production and trade (Matere 2020). The combination of these factors renders Kiambu and Murang'a counties suitable for investigating green bean certification in Kenya.


**Figure 2:** Map of Central Kenya highlighting the study areas
Source: Deisser and Njuguna 2016 (Adapted from George Philip Ltd. 1991)

## 4.4 Data Collection Instrument

Multiple data collection methods were employed to collect data from primary and secondary sources. For primary data, the methods included administered questionnaires, stakeholder interviews, and focus group discussions. For secondary data, an extensive literature review of selected journal articles, government and international agency policies and publications, technical documents, reports, and books was conducted to inform the approach used.

The data was collected by the researcher between 9th and 28th September 2024. The respondents were selected using area sampling, selecting participants from specific geographical areas, given the convenience and population concentration of green bean farmers. Local interpreters were employed to translate the questions from English to Swahili, helping farmers better understand the scope of the study.

The structured questionnaire was designed to collect data on the socio-economic characteristics of green bean farmers in Kenya, as well as assess the economic, social and environmental factors that influence their ability to meet EU quality standards (Annex 1). The questionnaire was divided into four sections, focused on (i) socio-economic characteristics of farmers (e.g., age, gender, education, farm size, income), (ii) economic factors influencing EU quality standards (e.g., loan access, market access, pricing), (iii) social factors influencing EU quality standards (e.g., access to information, training, group membership, certification) and (iv) environmental factors influencing EU quality standards (e.g., awareness of climate change, irrigation of green bean). Responses were reported via a 5-point Likert scale ranging from "Strongly agree" to "strongly disagree" and "Neither" to "Always". An in-depth Key Informant Interview was conducted to collect qualitative data.

**Table 3 - Itinerary of Qualitative Data Collection**

| Date | Informant | Location | Activity |
|---|---|---|---|
| **2024** | | | |
| Sept. 13 | **A** | Muranga | 1 x interview with extension agent |
| Sept. 24 | **B** | Nairobi | 1 x interview with a University of Nairobi, Kenya Lecturer |
| Oct. 10 | **C** | Czech Republic | 1 x interview with University of Nairobi, Kenya Professor |

## 4.5 Data Analysis

Data analysis was used to organise, inspect and transform data to highlight required information, suggest a conclusion and support a decision. Data were analysed using IBM SPSS Statistics software, version 28.0.1, Stata 17, and Microsoft Excel, while data description was performed using percentages, means, standard deviations, and frequencies.

A nonparametric statistical test was used to compare two independent variables and assess whether a significant difference existed between them. In this case, the purpose of this test was to compare the possession of certification (yes/no) between males and females. The Mann-Whitney U-test helps assess differences in the significance between male and female farmers with respect to possession or non-possession of green bean certification. The test was conducted from economic, social, and environmental perspectives.

**Table 4: Operationalisation of the factors influencing farmers compliance to quality standard of green beans**

| Category | Statement | Item | Scale | Supporting Literature |
|---|---|---|---|---|
| **Economic Perspective** | I believe that the following economic events will help me in meeting meet EU standards. | Land ownership<br>Access to credit<br>Access to farm machinery<br>Access to pesticides<br>Access to market and price | 0= customary, 1=statutory<br>1 = Strongly Agree, 5 = Strongly Disagree | Chelang'a et al. (2023) |
| **Social capital** | I believe that the following social factors support me in meeting EU standards. | Age<br>Education Level<br>Farming experience<br>Information access<br>Benefiting from extension service<br>Trainings<br>Capacity training<br>Visit of extension agent<br>Assistance of friends<br>EU quality control<br>Adaptive farming methods | 25 – 71<br>1=Nonformal, 6=Postgraduate<br>1 – 40<br>1 = Strongly Agree, 5 = Strongly Disagree | Gichuki et al. (2009) |
| **Environmental Perspective** | I believe the following environmental related statements | There is adequate rainfall<br>There is increased drought frequency<br>Disease can impact beans quality<br>There is increased temperature<br>Pesticides are expensive | 1 = Strongly Agree, 5 = Strongly Disagree | Shikuku et al. (2017) |

### 4.5.1 Quantitative Data Analysis

The Probit regression model is used to predict the probability of a binary outcome. Mathematically, the Probit model can be represented as:

$Pr\ (y = 1x) = \Phi(x\beta)$

Where:

- $Pr(y = 1x)$ is the probability of the binary outcome (y=1) given the predictor variables ($x$)
- $\Phi$ is cumulative distribution function (CDF) of the standard normal distribution
- $x$ is the vector of predictor variables
- $\beta$ is the vector of coefficients

The dependent variable in this study is farmers' certification status. The model estimates the possession and non-possession of certification based on the socio-economic factors. The independent variables include age, gender, years of education, farm size, land ownership type, farming experience, access to credit, access to technology, market distance, off-farm occupation and access to extension agents.

These variables were selected based on factors identified in the literature as influencing certification (the dependent variable) (Table 5). The potential presence of multicollinearity and endogeneity has been tested and found not to be an issue.

**Table 5: Operationalisation of the factors influencing possession of certification.**

| Variables | Unit of measurement | Description | Expected impact | Supporting literature |
|---|---|---|---|---|
| **Age** | Years | Age of a respondent | + | Okello & Swinton (2007) |
| **Gender** | Male/Female | Gender of Respondent | + | Okello et al. (2008) |
| **Years of education** | Years | No of years the respondent spent in formal education | +- | Chelang'a et al. (2023) |
| **Farm size** | Acres | Total number of acres belonging to the household | +- | Okello et al. (2008) |
| **Land Ownership** | Type | Customary or Statutory Land ownership | +- | Jayne et al. (2014) |
| **Farming Experience** | Years | Respondent's years of farming experience | +- | Hasan (2017) |
| **Access to credit** | 0 - Yes, 1 – No | Respondent has access to credit | + | Nouman et al. (2013) |
| **Access to technology** | 0– Yes, 1 - No | Respondent has access to technology | +- | Kariuki (2018) |
| **Market distance** | Km | Distance to the nearest regional market for farm products | + | Nambafu et al. (2024) |
| **Off-farm occupation** | 0 - Yes, 1 - No | Respondent has additional occupation apart from farming | +- | Ellis (2000) |
| **Access to extension agents** | 0 - Yes, 1 - No | Respondent has regular access to the extension agents | + | Arowosegbe et al. (2024) |

Note: "+" expected influence on certification; "+-" expected neutral influence on certification

### 4.5.2 Qualitative Data Analysis

Qualitative data analysis (QDA) was used to analyse various non-numerical data sources, including interviews, focus groups, surveys, documents, and audio recordings. In this research, MAXQDA software version 24 was used to analyse the key informant interviews. The interviews lasted about 40 minutes to 1 hour each. The key informant interview questions were also categorised into economic, social, and environmental issues to provide an overview of the factors influencing green bean production in Kenya. The questions explore economic, social and ecological challenges in green bean farming, including access to loans, land and government support. They also examine cooperative structures, labour practices, EU-farmer relations, certification processes, and communication channels. Environmental concerns focus on climate impacts, pesticide alternatives, Maximum Residue Limits (MRLs), and sustainable farming practices to meet EU standards. The questions asked are attached as Annex II**.**

# 5. Results

## 5.1 Socio-demographic characteristics of Green Beans Farmers

The socio-demographic profile of 194 green bean farmers reflects a relatively balanced gender distribution, with males comprising 54.6%, and females 45.4% (Table 6). The majority are middle-aged, with an average age of 43. Education levels are moderate, as 64.4% have attained secondary education. Farming experience varies, though 35.6% have practised for 10–19 years. Access to extension agents is available to 60.3% of respondents, mostly receiving support 3–5 times annually. Land ownership is predominantly under customary tenure (77.8%), and farm sizes are generally small, with 60.3% cultivating 0–1 hectare. Access to credit remains a challenge, with 56.7% lacking it; among those who do have access, formal sources are slightly more common. Group membership stands at 54.6%, indicating moderate collective engagement. A minority (24.2%) engages in off-farm occupations, such as business, carpentry, and teaching, to supplement limited farm income. These factors collectively influence productivity and market participation in green bean farming.

**Table 6: Socio-demographic characteristics of the green bean farmers**

| Variables | Unit of Measurement | Min. | Max. | Mean±S.D |
|---|---|---|---|---|
| Gender | 0 – Male, 1 – Female | | | 0.45 ± 0.49 |
| Age | Years | 25 | 71 | 48.00 ± 38.18 |
| Education level | Years | 0 | 19 | 9.50 ± 13.43 |
| Marital status | 1-Single 2-Married 3-Separated, 4-Divorced 5-Widowed | | | 1.95 ± 0.50 |
| Household size | Number | 1 | 11 | 6.00 ± 7.07 |
| Farming experience | Years | 1 | 40 | 20.50 ± 27.58 |
| Access to extension services | 0 – Yes, 1 – No | | | 0.41 ± 0.48 |
| Frequency of extension service in a year | Frequency | 1 | 7 | 4.00 ± 4.24 |
| Farmers group membership | 0 – Yes, 1 – No | | | 0.46 ± 0.50 |
| Farmers group type | 1-Producer, 2- Processors, 3-Marketing, 4 -Multipurpose, 5-Others | | | 0.56 ± 0.39 |
| Land size | Acres | 0.5 | 7 | 3.75 ± 4.59 |
| Land ownership type | 0 – Customary 1 – Statutory | | | 0.46 ± 0.50 |
| Sales of extra fine beans | Number of boxes | 33 | 3,000 | 1516.5 ± 303.30 |
| Access to credit | 0 – Yes, 1 – No | | | 0.57 ± 0.49 |
| Credit type | 0 – Formal, 1 – Informal | | | 0.19 ± 0.47 |
| Off-farm occupation | 0 – Yes, 1 – No | | | 0.76 ± 0.39 |
| Distance to main market | Kilometre | 1 | 8 | 4.50 ± 4.95 |
| Average income | Eur/Month | 7 | 150 | 78.50 ± 101.11 |

Note: 1EUR ≈ 130KSH Central Bank of Kenya (2024)

## 5.2 Comparison between Certified and Non-certified Farmers

The results in Table 7 present the analysis of the Mann-Whitney U-test comparing those with and without green bean certification, along with other demographic and farming-related variables. The variables also include male and female farmers. The table shows a significant difference (p-values < 0.05) between groups for many indicators. These include access to land, access to credit, visits from extension agents, access to information, and farming experience.

The results on access to credit indicate a significant difference between the genders, with males showing a higher level of significance. This suggests that male farmers have greater access to credit, influencing their ability to be certified. Regarding access to land, the results show a significant disparity in access to statutory land, which could affect farmers' possession of certification. A p-value of 0.011 suggests a significant effect on the frequency of extension agent visits to farmers. This reflects how guidance from extension agents can influence farmers' possession of certification. Access to information consistently affects farmers' ability to be certified. Also, a p-value of 0.032 for farming experience indicates that less experience can hinder farmers in meeting EU quality standards.

The analysis's results suggest that farmers who possess green bean certification tend to have better access to credit, statutory land, extension agents, and information, and greater farming experience than those without certification. Thus, this determines whether these farmers can meet the EU quality standards.

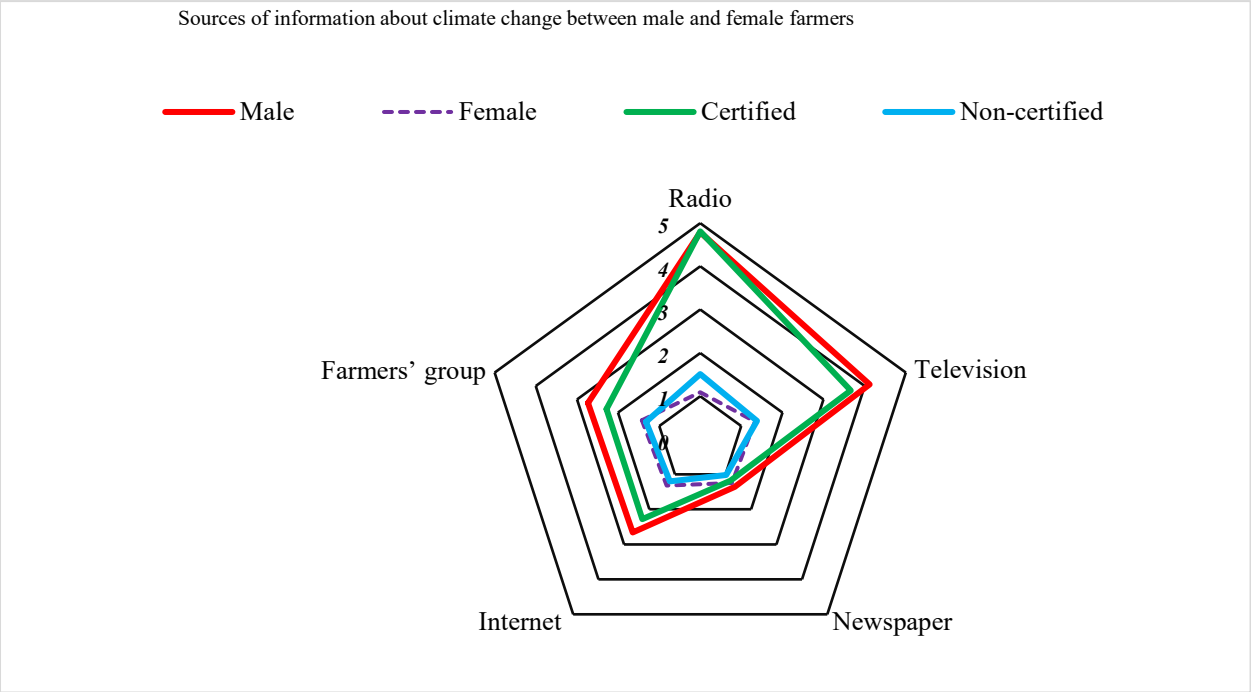
**Table 7: Selected Factors Influencing Compliance with EU Quality Standard of Green Beans**

| Category | Item | All Farmers | | Gender | | | Green bean certification | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean N = 194 | SD | Male N = 98 | Female N = 96 | p-value | Non-Certified N = 44 | Certified N = 150 | p-value |
| **Economic Perspective** | Access to credit | 2.04 | 0.934 | 1.79 | 1.03 | **0.027** | 3.47 | 1.41 | **0.013** |
| | Access to land | 1.54 | 0.671 | 1.67 | 2.02 | **0.019** | 3.02 | 1.51 | **0.021** |
| | Access to farm machinery | 2.56 | 1.293 | 3.34 | 1.44 | **<.001** | 3.11 | 1.13 | **0.006** |
| | Access to pesticides | 1.73 | 1.155 | 2.45 | 1.30 | **0.035** | 2.23 | 1.07 | **0.015** |
| | Access to market and price | 2.06 | 1.125 | 2.40 | 1.19 | **0.001** | 2.18 | 1.94 | **0.036** |
| **Social capital** | Information access | 1.72 | 1.021 | 1.41 | 1.23 | **0.024** | 2.18 | 1.95 | **0.012** |
| | Farming experience | 1.71 | 1.421 | 2.12 | 1.21 | **0.032** | 2.09 | 1.42 | **0.041** |
| | Capacity training | 2.92 | 1.104 | 2.13 | 1.26 | **<.001** | 3.14 | 1.11 | **0.011** |
| | Visit of extension agent | 2.10 | 1.214 | 3.21 | 1.73 | **0.011** | 2.32 | 1.21 | **0.034** |
| | Assistance of friends | 3.37 | 1.633 | 2.86 | 1.23 | <.**001** | 2.43 | 1.12 | **<.001** |
| **Environmental perspective** | Adequate rainfall | 2.82 | 1.303 | 3.51 | 1.37 | **<.001** | 3.09 | 1.30 | **0.005** |
| | Increased drought | 2.83 | 1.164 | 3.56 | 1.30 | **<.001** | 3.11 | 1.15 | **0.006** |
| | Disease impact | 1.50 | 0.685 | 2.07 | 4.58 | **0.002** | 3.35 | 1.35 | **0.012** |
| | Increased temperature | 2.11 | 0.144 | 2.86 | 1.28 | **0.011** | 2.40 | 1.14 | **0.034** |
| | Expensive farm inputs | 1.14 | 0.780 | 2.52 | 1.38 | **0.035** | 2.06 | 1.16 | **0.016** |

Note: (Bolded p-values shows the value is significant), 1 = strongly agree, 5 = strongly disagree

The figure below (Fig. 3) shows that both male and female farmers rely on the radio for climate change information, with a higher mean for males. Farmers with certification generally rely more on radio, the internet, and farmers' groups than those without certification. Neither group uses newspapers as a source of information.

**Fig 3: Sources of information about climate change between male and female farmers**



## 5.3 Factors Influencing Compliance to EU Quality Standards

The Probit regression results provide empirical insights into the determinants of farmers' adherence to meet EU quality standards for green bean export. The analysis tests four hypotheses, each discussed in prior literature, concerning gender, access to extension services, education level, and farm size. The findings support three of the proposed hypotheses.

Gender emerges as a statistically significant variable, indicating that male farmers are more likely to be meet compliance rules in terms of certification for green bean export. Thus, $H_1$ was confirmed. Similarly, access to extension agents is significantly associated with certification status. This indicates that extension services play a critical role in facilitating compliance with export standards by providing technical guidance and disseminating information. This confirms $H_2$. Years of education are also a significant predictor of certification. This supports the hypothesis that higher educational attainment enhances farmers' capacity to understand and implement the complex requirements of certification schemes.

Contrarily, the result does not support the hypothesis regarding farm size. The insignificance of farm size suggests that certification is not exclusively accessible to large-scale farmers, challenging the assumption that landholding scale is a key determinant of certification. This may indicate the increasing inclusivity of certification programs, particularly where Frigoken support mechanisms are in place.

In addition to the hypothesised variables, several other factors, such as land ownership type, access to credit, access to technology, and off-farm occupation, are found to be significant, suggesting that broader socio-economic and environmental conditions influence certification outcomes. Notably, market distance does not exert a statistically significant effect, suggesting that geographic proximity to export markets is not a primary constraint on meeting EU quality standards.

**Table 8: Factors influencing possession of certification for green bean export**

| Variable | Coef. | Std. Err. | z-value | p-value | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| Age | 0.076 | 0.029 | 2.14 | **0.015** | 0.010 | 0.161 |
| Gender | 1.493 | 0.618 | 2.12 | **0.022** | 0.186 | 3.000 |
| Years of education | 0.175 | 0.078 | 2.05 | **0.026** | 0.013 | 0.358 |
| Farm size | -0.352 | 0.223 | -1.26 | 0.222 | -1.072 | 0.156 |
| Land ownership type | 3.502 | 0.772 | 3.22 | **0.021** | 1.892 | 5.325 |
| Farming experience | 0.021 | 0.022 | 0.25 | 0.628 | -0.051 | 0.074 |
| Access to credit | 1.081 | 0.549 | 1.82 | **0.045** | -0.016 | 2.178 |
| Access to technology | 1.281 | 0.627 | 1.71 | **0.034** | 0.214 | 2.322 |
| Market distance | 0.021 | 0.227 | 0.42 | 0.365 | -0.346 | 3.201 |
| Off-farm occupation | 1.525 | 0..521 | 1.99 | **0.031** | 0.237 | 3.001 |
| Access to extension agents | 4.227 | 0.621 | 4.92 | **0.019** | 6.197 | 2.717 |
| *Constant* | *-7.125* | *2.179* | *-3.27* | *0.001* | *-11.398* | *-2.852* |

| | |
|---|---|
| Log likelihood | -18.568 |
| Pseudo $R^2$ | 0.326 |
| LR $Chi^2$ (12df) | 173.02 |
| Prob. > $Chi^2$ | 0.001 |
| SD dependent var | 0.362 |
| Akaike crit. (AIC) | 63.136 |
| Bayesian crit. (BIC) | 105.607 |
| Number of observations | 194 |

Note: The bold p-values shows significance

## 5.4 Perspectives of Stakeholders

The first aspect of the informant's perspective concerned the challenges green bean farmers face in accessing financial resources. Banks are hesitant to provide loans due to the perceived high risk of agricultural investments. As a result, farmers often rely on small cooperative investment groups or support from private organisations, though these options have limitations. Compliance with global market standards is also a significant financial burden. The informants noted that the government incentives are insufficient and that private firms, while providing some support, often impose pricing structures that limit farmers' earnings. The informants also discussed financial constraints, a lack of support, and rigid market structures as contributing factors to the difficulties farmers face in sustaining their livelihoods. Overall, the informants share similar views on the economic challenges faced by green bean farmers and the limitations of current support systems, presenting a consistent picture of these challenges.

Regarding social issues, it was explained that cooperatives in Kenya exist in both formal and informal forms. Formal cooperatives are registered entities with elected officials and access to financial assistance, whereas informal cooperatives operate on trust and small-scale savings. "The formal ones have a better structure, and even the banks sometimes recognise them, making it easier for them to access loans." (Informant A) Farmers frequently rely on their own labour or family members to reduce costs, though larger farms employ external labour. Market dynamics are also influenced by international buyers, particularly from the EU, who set stringent standards without direct engagement with farmers. Communication between farmers and international markets occurs primarily through third-party intermediaries, thereby limiting farmers' ability to negotiate prices or raise concerns. "For farmers themselves, I don't think they directly communicate with the European market. It's only through the third party", informant B explained. As a result, farmers often have little control over pricing and are sometimes forced to accept predetermined rates that do not account for fluctuating production costs.

On environmental issues, the informant C noted that climate change poses a significant threat to farming. Many farmers rely on rainfall, and water scarcity often compels them to draw water from rivers, which can lead to environmental degradation. "Because of climate change, they really rely on rainfall, so they have to use water from the river as a means of irrigation,"

she stated. The use of chemicals also affects soil and water quality, as some farmers resort to unapproved pesticides to protect their crops. "Some of these farmers will sneak in and bring some of these chemicals, which are not allowed," the informant admitted. Land scarcity and overuse further complicate sustainable farming practices, leading to deforestation as farmers clear new land for cultivation. Compliance with maximum residue limits (MRL) set by export markets presents another challenge. Additionally, the informant noted that many farmers lack awareness of these regulations and often encounter unexpected rejections of their produce, resulting in severe financial losses. "It's like you brought your produce, and then they just say, 'Oh, this one is beyond the allowed limit. We are rejecting your produce. In some cases, this has resulted in extreme distress, including farmer suicides. "There was even a farmer who committed suicide because of that," he revealed. Farmers also struggle with the high costs of environmentally friendly pesticides mandated by European importers, but not financially accessible. "Most of these pesticides are very expensive, she noted. Mitigation efforts, such as government-supported tree-planting initiatives, provide some relief; however, broader support mechanisms are needed to ensure sustainable and profitable farming practices. However, one of the informants noted that the government provides free seedlings to encourage tree planting, and farmers have been observed picking them up.

Insights from the three key informants illustrate the complex interplay of economic, social, and environmental factors affecting green bean farmers. While private-sector involvement provides some support, limited government intervention and rigid international regulations continue to pose significant challenges. Addressing these issues requires a multifaceted approach that enhances financial accessibility, strengthens farmer representation in market negotiations, and promotes sustainable agricultural practices.

# 6. Discussion

The attainment of EU quality standards in green bean farming in Kenya is shaped by an interplay of socio-demographic, social, economic, environmental and some regulatory factors. At its core, the EU's stringent requirements and policies set the benchmark for production, handling, and post-harvest practices. These standards dictate not only the selection of green beans but also the overall farming methodologies employed by producers targeting the export market. Compliance with these standards is non-negotiable; failure to comply results in exclusion from the lucrative EU market.

A critical enabler in this system has been Frigoken's involvement, an organisation specialising in the production and export of value-added vegetables, particularly green beans, which has significantly influenced farmers' preparedness and compliance. Through its campaigns and capacity-building initiatives, Frigoken has played a pivotal role in aligning farmers with the expectations of the EU standards and market. Their interventions, often customised to the specific challenges and needs of individual farmers, have fostered a deeper understanding of quality requirements and helped catalyse improvements in farming practices. This organisational support has also contributed to increased awareness around responsible farming practices, ultimately leading to higher yields of quality green beans.

In addition, the socio-demographic profile of farmers emerged as a key determinant of their ability to meet quality standards. Factors such as age and farming experience often translate into accumulated knowledge and adaptive practices that align with sustainable agriculture. Older farmers may leverage their long-standing exposure to varied agricultural conditions and evolving market demands to adopt more effective strategies that enhance quality. This finding was supported by Adong (2014), who found that older farmers are more likely to adopt sustainable agricultural practices. The experiences and knowledge gained over time can help older farmers make informed decisions about farming practices, resulting in higher-quality green beans. This also reflects that experiential learning remains a valuable asset in the face of dynamic production standards. Gender dynamics also appear to influence certification outcomes. Differential access to resources, training opportunities, and decision-making power often gives male farmers an advantage, enabling them to mobilise the inputs required to meet certification standards. This disparity emphasises the structural inequalities within agricultural systems, highlighting the need for gender-sensitive policies and

interventions that promote equitable access to production resources and support services. The findings by Quisumbing et al. (2014) revealed that male farmers often have greater control over productive resources, such as land, labour and inputs, which can impact their ability to meet quality standards connected to certification

Education emerged as another critical factor in enhancing farmers' capacity to interpret and apply complex quality protocols. Farmers with higher educational attainment are more likely to comprehend regulatory frameworks and integrate them into their daily operations. Beyond knowledge acquisition, education fosters critical thinking and innovation, both of which are crucial for navigating the technical aspects of certification processes. This dimension emphasises the importance of integrating rural education into agricultural training programs. A study by Karipidis (2014) found that education is a significant predictor of farmers' adoption of certification processes.

Land tenure security was also revealed to be a significant enabler of quality compliance. Farmers with statutory land ownership are more likely to invest in long-term, quality-enhancing practices because of greater confidence in the security of their investments. Secure land tenure serves as a foundation for sustainable farming decisions, encouraging the adoption of modern practices and the infrastructure improvements necessary for certification. This aligns with the findings of Leonhardt et al. (2019), who reported that farmers with secure land tenure systems can invest in their land and adopt effective soil conservation practices.

The availability of extension services is another critical enabler for meeting EU quality standards in green bean farming. These services serve as a bridge between regulatory expectations and local farming realities, providing technical guidance, disseminating information, and supporting continuous capacity development. When well implemented, extension systems improve not only farmers' technical competence but also their awareness of global market requirements. These findings corroborate those of Malimi (2023), who found that public investment in agricultural input subsidies and extension services yields broad benefits for farmers, including increased farm productivity and overall profitability of the farming enterprise.

Furthermore, access to credit is vital for supporting farmers' investment in quality-enhancing technologies and practices. Financial constraints often prevent farmers from adopting necessary inputs or implementing infrastructure improvements; however, with adequate credit, they are better positioned to comply with EU standards. A study by Le Courtois et al (2010)

found that access to credit can improve farmers' ability to meet EU quality standards and certification criteria.

Off-farm income sources also contribute to adherence to quality standards. Supplemental income provides a financial buffer that can be reinvested in farming operations, enabling the purchase of better inputs or the hiring of skilled labour. These findings align with those of Reardon et al. (2007), who found that off-farm occupations can provide additional income and resources, enabling investment in farms.

Conversely, farm size, often assumed to be a primary driver of output and efficiency, was not a decisive factor in achieving EU quality standards. Smaller farms, when well-managed, can outperform larger ones in terms of quality through closer supervision, better labour utilisation, and the adoption of improved agronomic practices. This was supported by the findings of Ali et al (2019), who found that smallholder farmers can achieve high levels of productivity and quality through intensive management and the use of improved technologies.

Also, market distance appears insignificant. This suggests that certification focuses on standards rather than location; thus, proximity to markets may not be a primary constraint on achieving compliance. Also, exporters often collect produce directly from farms or central collection points, reducing the relevance of a farmer's distance from the market. These findings were supported by Henson et al. (2005), who found that, in meeting EU quality standards, proximity to markets or distance is not a barrier; rather, access to technical assistance and buyer networks is the key factor.

Overall, the findings show that achieving EU quality standards is not merely a function of individual factors but a holistic outcome shaped by knowledge, access to resources, organisational support, and policy environments. Addressing these multidimensional factors in a coherent and inclusive manner is essential to enhancing Kenya's capacity to sustain and expand its green bean farming in the competitive EU green bean market.

This study faced several limitations that influenced the data collection process, sample selection and research outcomes. There is a restriction in collecting detailed information from farmers and stakeholders who speak local languages. This hindered the collection of firsthand information from farmers about their experiences, challenges, and perceptions regarding EU quality standards. Also, insufficient funding to support data collection, transportation and other research-related expenses limited the collection of comprehensive data and engagement with a

diverse range of stakeholders. Accessing remote or rural areas where green bean farmers are located was a herculean task. Some roads leading to remote areas were in poor condition. This limited the conduction of field visits and the collection of some data. Finally, the inability to access or engage with an experienced intermediary in the green bean industry, due to his busy schedule, limited the collection of certain data. Every attempt to schedule interviews at the intermediary's convenience or to explore alternative sources of information, such as his industry reports or academic studies, proved unsuccessful. To mitigate these limitations, future researchers can use local interpreters, prioritise funding, employ alternative data-collection methods, collaborate with local organisations and authorities, and create flexible schedules for busy stakeholders.

# 7. Conclusions

This study examined the key factors influencing local farmers compliance with EU quality standards of green bean farming in Kenya. The findings showed that adherence to these standards was not solely dependent on structural attributes such as farm size or market proximity but was instead driven by an intricate interplay of socio-demographic, economic, social capital and environmental factors. Notably, variables such as age, gender, years of education, land ownership type, access to credit, access to technology, off-farm occupation, and access to extension services emerged as significant enablers of certification and compliance, reinforcing the critical role of knowledge, institutional support, and socio-economic positioning in navigating the complexities of international market standards. The role of certification organisations, particularly Frigoken, further highlighted how targeted organisational interventions can bridge capacity gaps among farmers, fostering widespread understanding and adoption of quality-enhancing farming practices.

Contrary to conventional assumptions, farm size and market distance were found to be insignificant, suggesting a paradigm shift toward inclusivity in the farming and export of green beans. These results advocate for policy frameworks that emphasise capacity-building, equitable access to resources, and gender-responsive support systems.

Based on these insights, several recommendations are proposed. First, stakeholders should prioritise expanding and enhancing extension services, ensuring that technical assistance is both accessible and contextually relevant. Second, gender-sensitive interventions must be integrated into agricultural programs to address structural inequalities and support the equitable distribution of training and inputs. Third, improving access to affordable credit and financial literacy programs will enhance farmers' ability to invest in quality-compliant technologies and infrastructure. Finally, investments in rural education and land tenure security will be instrumental in sustaining long-term compliance and competitiveness in export agriculture.

# 8. References


Adong A. 2014. Impact of households' membership of farmer groups on the adoption of agricultural technologies in Uganda: evidence from the Uganda Census of Agriculture 2008/09. *Agrekon*, *53*(2), 108-136. https://doi.org/10.1080/03031853.2014.915485.

Ali DA, Bowen D, Deininger K, Duponchel M. 2019. Investigating the gender gap in agricultural productivity: Evidence from Uganda. *World Development*, 124, 104652. https://doi.org/10.1016/j.worlddev.2016.06.006.

Arowosegbe OB, Alomaja OA, Tiamiyu BB. 2024. The role of agricultural extension workers in transforming agricultural supply chains: enhancing innovation, technology adoption, and ethical practices in Nigeria. *World Journal of Advanced Research and Reviews*. 2024;23(3):2585-602. https://doi.org/10.30574/wjarr.2024.23.3.2962.

Asfaw S, Mithöfer D, Waibel H. 2009. Investment in compliance with GlobalGAP standards: Does it pay off for small-scale producers in Kenya? *Quarterly Journal of International Agriculture*, 48:337–362.

Beatious K. 2024. Green Bean Farming in Kenya: from farm to home, Agritunity. pp.123, https://agritunity.com. (accessed March 2025).

CBI 2022. The European market potential for canned beans. Available from https://www.cbi.eu/market-information/processed-fruit-vegetables-edible-nuts/canned-beans/market-potential. (accessed March 2025)

Central Bank of Kenya. "Monthly Economic Review – October 2024." https://www.centralbank.go.ke/. (accessed October 2024).

Chelang'a NC, Kariuki IM., Obare GA, Otieno DO. 2023. Determinants of adoption of GLOBAL G.A.P. standards: Evidence from smallholder French beans farmers in Murang'a County, Kenya. Cogent Food & Agriculture. https://doi.org/10.1080/23311932.2023.2176949

D'Alessandro SP, Caballero J, Lichte J, Simpkin S. 2015. Kenya: Agricultural Sector Risk Assessment. Agriculture global practice technical assistance paper.. https://doi.org/10.1596/23350

Deisser AM, and Njuguna M. 2016. *Conservation of natural and cultural heritage in Kenya* (p. 181). UCL Press. https://doi.org/10.14324/111.9781910634844

Ellis F. 2000. Rural Livelihoods and Diversity in Developing Countries. *Oxford University Press*:1–220. https://doi.org/10.1093/oso/9780198296959.001.0001

Elosy K, Mburu J. 2012. Opportunities and challenges for youth ' s participation in horticultural production in the face of GlobalGAP standards in Kenya. International Conference on 'Young People, Farming and Food' Accra, Ghana. March 19-21, 2012:29.

European Commission 2019. Directorate-General for Communication. 2019. *From farm to fork : the European Green Deal*. Publications Office. https://doi.org/10.2775/691860

FAO 2014. Country Programming Framework for Kenya - 2014-2017. Available from https://www.explodingafrica.com/wp-content/uploads/2018/01/Country-Programming-Framework-for-Kenya-2014-2017_FAO.pdf. (accessed October 2024).

FAO 2018. Post-harvest management of snap bean for quality and safety assurance.

Secretariat IPPC (2023). *2022 IPPC Annual Report–Protecting the world's plant resources from pests*. Food & Agriculture Org. https://openknowledge.fao.org/handle/20.500.14283/i8229en. (accessed October 2025).

Fischer E, Qaim M. 2012. Linking Smallholders to Markets: Determinants and Impacts of Farmer Collective Action in Kenya. *World Development* 40(6):1255–1268. https://doi.org/10.1016/j.worlddev.2011.11.018

Freidberg S. 2003. French beans and food scares: culture and commerce in an anxious age. *On labor conditions in Kenya's horticultural industry, see C. Dolan, 'On farm and packhouse: employment at the bottom of a global value chain', Rural sociology*. https://doi.org/10.1093/oso/9780195169607.001.0001

Fulano AM, Lengai GMW, Muthomi JW. 2021. Phytosanitary and Technical Quality Challenges in Export Fresh Vegetables and Strategies to Compliance with Market Requirements: Case of Smallholder Snap Beans in Kenya. *Sustainability*, 13(3), 1546.. https://doi.org/10.3390/su13031546.

Gwengi E. 2010. Strategic change management at Frigoken Kenya limited (Doctoral Dissertation).

Hasan SMM. 2017. *Factors affecting integrated pest management adoption and pesticide use in Kenyan vegetable farmers* (Doctoral dissertation, Virginia Tech).

Henson S, Masakure O, Boselie D. 2005. Private food safety and quality standards for fresh produce exporters: The case of Hortico Agrisystems, Zimbabwe. Food policy, 30(4), 371-384. https://doi.org/10.1016/j.foodpol.2005.06.002

Henson S, Masakure O, Cranfield J. 2011. Do fresh produce exporters in Sub-Saharan Africa benefit from GLOBALG.A.P certification? *World Development*, 39(3), 375–386. https://doi.org/10.1016/j.worlddev.2010.06.012.

Henson S. 2008. Linking African Smallholders to High-Value Markets: Practioner Perspectives on Benefits, Constraints, and Interventions (Vol. 4573). World Bank Publications. https://doi.org/10.1596/1813-9450-4573.

Infonet-Biovision. 2014. Crops. Available online: https://infonet-biovision.org/processing-and-value-addition/basic-export-requirements-fruitvegetable-kenya (accessed on 20 December 2025).

Jaffee S, Henson S, Diaz Rios L. 2011. Making the Grade: Smallholder Farmers, Emerging Standards, and Development Assistance Programs in Africa — A Research Program Synthesis. Economic and Sector Work Report 62324-AFR. World Bank, Washington, DC. https://doi.org/10.1596/2823.

Jaffee S, Masakure O. 2005. Strategic use of private standards to enhance international competitiveness: Vegetable exports from Kenya and elsewhere. *Food Policy*, *30*(3), 316-333. https://doi.org/10.1016/j.foodpol.2005.05.009.

Jayne TS, Chamberlin J, Headey DD. 2014. Land Pressures, the Evolution of Farming Systems, and Development Strategies in Africa. *Food Policy,* 48:1–17. https://doi.org/10.1016/j.foodpol.2014.05.014.

Jones K, Njeru EM, Garnett K, Girkin N. 2024. Assessing the impact of voluntary certification schemes on future sustainable coffee production. *Sustainability*, *16*(13). https://doi.org/10.3390/su16135669.

Karipidis P, Tselempis D. 2014. Farmers' intention to maintain quality certification. *EuroMed Journal of Business*, Vol. 9 No. 1 pp. 93–110, https://doi.org/10.1108/EMJB-04-2013-0015.

KALRO 2019. Green beans production guide. Kenya Agricultural and Livestock Research Organization. (accessed November 2025).

Kariuki I, Loy J, Herzfeld T. 2018. Farmgate Private Standards and Price Premium: Evidence from the GlobalGAP Scheme in Kenya's French Beans Marketing. *Agrekon,* 57(1), 59–74. https://doi.org/10.1002/agr.20286.

Kenya National Bureau of Statistics (KNBS) & Ministry of Agriculture & Livestock Development (MoALD). 2024. *National Agriculture Production Report – 2023/2024.* KNBS & MoALD, Nairobi. (accessed December 2025).

KPHC. 2019. *2019 Kenya Population and Housing Census: Volume IV*. Kenya National Bureau of Statistics. (accessed November 2025).

Le Courtois E, Gálvez-Nogales E, Santacoloma P and Tartanac F. 2010. Enhancing farmers

access to markets for certified products: A comparative analysis using a business model approach.

Lengai GM, Fulano AM, Muthomi JW. 2022. Improving access to export market for fresh vegetables through reduction of phytosanitary and pesticide residue constraints. *Sustainability*, *14*(13), 8183. https://doi.org/10.3390/su14138183.

Leonhardt H, Penker M, & Salhofer K. 2019. Do farmers care about rented land? A multi-method study on land tenure and soil conservation. *Land use policy*, *82*, 228-239. https://doi.org/10.1016/j.landusepol.2018.12.006.

Malimi K. 2023. Agricultural input subsidies, extension services, and farm labour productivity nexus: Evidence from maize farmers in Tanzania. *Journal of Agricultural Economics*, *74*(3), 874-898. https://doi.org/10.1111/1477-9552.12537.

Matere NJ. 2020. Developing ecofriendly approach for management of pests and diseases of green beans in Murang'a and Kiambu counties, central Kenya. "Doctoral Dissertation" (2020)

Meemken EM, Qaim M. 2018. Can Private Food Standards Promote Gender Equality in the Small Farm Sector?" *Journal of Rural Studies* 58: 39–51. https://doi.org/10.1016/j.jrurstud.2017.12.030.

Ministry of Agriculture, Livestock, Fisheries and Cooperatives (MoALFC) (2021). *Agricultural Policy-2021 "Food: Our Health, Wealth and Security".*

Munga B, Onsomu E, Laibuni N, Njogu H, Shibia A, Luseno S. 2021. Industries without smokestacks in Africa: A Kenya case study. https://doi.org/10.13140/RG.2.2.16952.06403.

Muriithi BW. 2008. Compliance with eurepgap standards: determinants, costs and implications on profitability among smallholder french beans exporters in Kirinyaga district, Kenya. 8:165–175. https://doi.org/10.22004/ag.econ.117712.

Muriithi BW, Mburu J, Ngigi M. 2011. Constraints and determinants of compliance with EurepGAP standards: A case of smallholder French bean exporters in Kirinyaga District, Kenya. *Agribusiness*, 27(2), 193–204. https://doi.org/10.1002/agr.20261.

Nambafu SN, Bett H, Sibiko K. 2024. Determinants of commercialization of African Indigenous Vegetables among smallholder farmers in Bungoma County, Kenya. *Discover Agriculture*. https://doi.org/10.1007/s44279-024-00013-6.

Ngutu M, Bukachi SA, Olungah CO, Haller T. 2018. Opportunities and challenges in export horticulture as an agro-industrial food system: Case study of Northwest Mount Kenya

Region. *International Journal on Food System Dynamics*, 9(5), 470–483. http://dx.doi.org/10.18461/ijfsd.v9i5.957.

Njoba JW, Owuor G, Wolukau J. 2016. The Influence of Global GAP Certification on the Performance of Small-scale French Beans Growers in Central Kenya. The International Journal Of Business & Management 4:196–204. Available from www.theijbm.com.

Nouman M, Siddiqi MF, Asim SM, Hussain Z. 2013. Impact of Credit Disbursement, Area under Cultivation and Fertilizer Consumption on Agricultural Production in Pakistan (1972–2012). *International Journal of Advanced Research in Management and Social Sciences*, 2(12), 108–125.

Nthambi M, Mburu J, Nyikal R. 2013. Smallholder Choice of Compliance Arrangements : The Case GlobalGAP adoption Smallholder Choice of Compliance Arrangements : The Case GlobalGAP adoption by French Bean Farmers in Kirinyaga , Mbooni and Buuri / Laikipia Districts. https://doi.org/10.22004/ag.econ.161471.

Ochieng DO, Veettil PC, Qaim M. 2017. Farmers' preferences for supermarket contracts in Kenya. *Food Policy*, *68*, 100-111. https://doi.org/10.1016/j.foodpol.2017.01.008.

Odero DO, Mburu JI, Ackello-Ogutu C, Nderitu JH. 2013. Value chain analysis of smallholder snap bean production in Kirinyaga County, Kenya. https://doi.org/10.22004/ag.econ.161526.

Odhiambo VO, Hendriks SL, Selomane O. 2026. Quantifying and monetising externalities in Kenya's green bean value chain: implications for stakeholder and policy actions', *Journal of Agriculture and Food Research*, vol. 26, art. 102639. https://doi.org/10.1016/j.jafr.2026.102639

OECD. 2019. *Agricultural Policy Monitoring and Evaluation 2019: Kenya.* OECD Publishing, Paris. https://doi.org/10.1787/22217371.

Okello JJ, Swinton SM. 2007. Compliance with International Food Safety Standards in Kenya's Green Bean Industry. *Review of Agricultural Economics* 29(2):269–285. https://doi.org/10.1111/j.1467-9353.2006.00342.x.

Okello JJ, Narrod C, Roy D. 2007. *Food safety requirements in African green bean exports and their impact on small farmers*. Intl Food Policy Res Inst. https://doi.org/10.22004/ag.econ.42362.

Okello JJ, Narrod C, Roy D. 2008. Institutional Innovations for Smallholder Compliance with International Food Safety Standards: Experiences from Kenya, Ethiopian and Zambian Green Bean Growers. *Proceedings of the African Association of Agricultural Economists*

*(AAAE) Second International Conference, August 20–22, 2007, Accra, Ghana*:1–12. https://doi.org/10.22004/ag.econ.52183.

Okello JJ, Narrod C, Roy D. 2011. Export standards, market institutions and smallholder farmer exclusion from fresh export vegetable high value chains: experiences from Ethiopia, Kenya and Zambia. *Journal of Agricultural Science*, *3*(4), 188. https://doi.org/10.5539/jas.v3n4p188.

Otieno PS, Ogutu CA, Mburu J, Nyikal RA. 2017. Effect of Global-GAP policy on climate change perceptions of smallholder French beans farmers in Central and Eastern Regions, Kenya. *Climate*. https://doi.org/10.3390/cli5020027.

Quisumbing AR, Meinzen-Dick R, Njuki J. 2014. Closing the gender asset gap: Learning from value chain development in Africa. Int. Food Policy Research Institute. http://dx.doi.org/10.2139/ssrn.2405716.

Reardon, T., Berdegué, J., Barrett, C. B., & Stamoulis, K. (2007). Household income diversification into rural nonfarm activities. *Transforming the rural nonfarm economy: opportunities and threats in the developing world*, *2*(4), 115-140.

Ribot JC, Peluso NL. 2003. Theory of Access. *Rural Sociol*. 68:153–181. https://doi.org/10.1111/j.1549-0831.2003.tb00133.x.

Shikuku KM, Winowiecki L, Twyman J, Eitzinger A, Perez JG, Mwongera C, Läderach P. 2017. Smallholder farmers' attitudes and determinants of adaptation to climate risks in East Africa. *Climate Risk Management*, 16, 183–194. https://doi.org/10.1016/j.crm.2017.03.001.

UNEP 2021. Making peace with nature: A scientific blueprint to tackle the climate, biodiversity and pollution emergencies. https://www.unep.org/resources/making-peace-nature (accessed March 2025).

USAID 2015. French bean value chain analysis. https://pdf.usaid.goc/pdf_docs/PA00MSX6.pdf. (accessed on December 2025).

USAID 2022. Advancing nutrition - The State of Food and Agriculture. https://www.advancingnutrition.org/resources/state-food-and -agriculture-2022. (accessed on December 2025).

# Appendix

## Annex I

### Questionnaire

### ASSESSING THE FACTORS INFLUENCING COMPLIANCE TO EUROPEAN UNION QUALITY STANDARDS OF GREEN BEANS IN KENYA

**Dear Sir/Madam,**

I would like to ask you to fill in the following questionnaire. I am David Fakayode, a student at the Czech University of Life Science Prague, Czech Republic, and I am conducting this study focusing on "***Assessing the factors influencing compliance to European Union quality standards of green beans in Kenya''***. All the data are collected anonymously. The filling would only take a few minutes. I would appreciate very much if you would fill in and help me to conduct this research. Thank You!

**Identification**

District ……...

Date of the interview …….

**Section A: Socio-economic Characteristics**

| | |
|---|---|
| 1. What is your Gender? | Male ☐ Female ☐ |
| 2. What is your age (in years)? | |
| 3. What are your years of education? | |
| 4. What is your highest education level? | Nonformal☐, Primary☐, Secondary☐, NCE/Diploma☐, Graduate☐, Postgraduate☐ |
| 5. What is your marital status? | Single☐, Married☐, Separated☐, Divorced☐, Widowed☐ |
| 6. What is your household size (in persons)? | |
| 7. What are your years of farming experience? | |
| 8. Do you have access to extension services? | Yes ☐ No☐ |
| 9. If yes, how frequent in a year (in number)? | |
| 10. Are you a farmers' group member? | Yes ☐ No☐ |
| 11. If yes, which type of group? (Multiple choice is allowed) | Producer☐, Processors☐, Marketing☐, Multipurpose☐, Others…… |
| 12. What type of information/services received from the group (multiple choice is allowed)? | Weather☐, Climate change adaptation ☐Crop related☐, Certification☐, Market (including price) ☐, Others (specify)…… |
| 13. Do you own a land? | Yes ☐ No☐ |

| | |
|---|---|
| 14. If yes, what type of land ownership? | Customary☐ Statutory☐ |
| 15. And what is the size of land owned (ha)? | |
| 16. What size of land is under cultivation (ha)? | |
| 17. What are the species of green beans cultivated? | Fresh Beans<br>Belle Campo☐, Vanilla☐, Samantha☐, Star☐, Serengeti☐, Boston☐, Soria☐, and Lomami☐, Others (specify)……<br>Canned Beans<br>Goal☐, Source☐, Catarina☐, Caledonia☐, and Sagana☐ Others (specify)…… |
| 18. Do you have access to credit? | Yes ☐ No☐ |
| 19. If yes, which type of credit? | Formal☐ Informal☐ |
| 20. Do you have an off-farm occupation? | Yes ☐ No☐ |
| 21. If yes, what is your major off-farm? | |
| 22. What is your distance to main market (km) | |
| 23. What is your average income (Ksh/Month) | |

**Section B: Economic Factors influencing Quality Standards**

| | | |
|---|---|---|
| 24. Are you aware about EU grades and standards on green beans? | Yes ☐ | No☐ |
| 25. Are you familiar about EU laws on green beans? | Yes ☐ | No☐ |
| 26. Do you possess any green beans quality certification? | Yes ☐ | No☐ |
| 27. If yes, for how long? (in years) | | |
| 28. Do you control price? | Yes ☐ | No☐ |
| 29. Do you grow green beans under contract with an export company? | Yes ☐ | No☐ |
| 30. If yes, which exporter(s) did you produce for between 1st Jan 2023 and 31st Dec 2023? (*Tick all that apply*) | Homegrown☐ Vegpro☐ Woni☐ Sacco Fresh☐ KHE☐ Sunripe☐ East Africa Growers☐ Greenlands☐ Other (specify)_____ | |

A. What is your perception on the following economic events helping you meet the EU standards.

| Event | Strongly Disagree | Disagree | Undecided | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 31. I believe access to loan/credit will help me meet the EU standards | | | | | |
| 32. I believe access to seeds will help me meet the EU standards | | | | | |
| 33. I believe access to farm machinery will help me meet EU standards | | | | | |
| 34. I believe access to pesticides will assist me in meeting EU standards | | | | | |
| 35. I believe access to market will aid me in meeting EU standards | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 36. I believe market price will help me in meeting EU standards | | | | | |
| 37. I believe access to fertilizers will help me in meeting EU standards | | | | | |
| 38. I believe access to land is vital for me meeting the EU standards? | | | | | |
| 39. I believe access to labor will help you meet the EU standards? | | | | | |

**40.** Please indicate below the quantity of each grade of green beans you sold and the price you received for each grade during the last crop season.

| **Extra fine** | | **Fine beans** | | **Bobby beans** | |
|---|---|---|---|---|---|
| Boxes sold | Price (Ksh/box) | Boxes sold | Price (Ksh/box) | Boxes sold | Price (Ksh/box) |
| | | | | | |

**Section C: Social Factors influencing Quality Standards**

| | |
|---|---|
| 41. What is the source of your quality standard information? (Multiple choice is allowed) | Government extension agent☐, Environmental NGOs☐, Farmers groups☐, Research institution/University☐, Farmers friends ☐, Others(specify)…… |
| 42. What are your three main reasons for choosing to produce under contract? Please rank. | 1=Assured market for my green beans----<br>2=Easier access to current information-----<br>3=Higher prices-------<br>4=Easier access to new pesticides--------<br>5= Easier access to cash credit---<br>6=Easier access to quality seed---<br>7=Stable prices--------<br>8=Other (specify)----- |

Consider the following social events, what is your perception about them?

| **Event** | **SD** | **D** | **UD** | **A** | **SA** |
|---|---|---|---|---|---|
| 43. I believe access to information helps me to meet the EU standards | | | | | |
| 44. I believe possession of certification makes it easy to meet the EU standards | | | | | |
| 45. I believe farming experience helps in meeting EU standards | | | | | |
| 46. I believe assistance from friends during farm season helps in meeting the EU standards | | | | | |
| 47. I believe access to extension services assist in meeting the EU standards | | | | | |
| 48. I believe group membership belonging helps in meeting the EU standards | | | | | |
| 49. I believe trainings are essential in meeting EU standards | | | | | |

**SD= Strongly disagree, D=Disagree, UD=Undecided, A=Agree and SA=Strongly agree**

| How frequent are the following events during farming season |
|---|

| Event | Never | Rarely | Sometimes | Often | Always |
|---|---|---|---|---|---|
| 50. Farming information (price fluctuation) | | | | | |
| 51. Capacity training | | | | | |
| 52. Visit of extension agents | | | | | |
| 53. Assistance from friends | | | | | |
| 54. EU quality control | | | | | |
| 55. Adaptive Farming methods | | | | | |

**Section D: Environmental Factors influencing Quality Standards of Green Beans**

| | | |
|---|---|---|
| 56. Are you aware about climate change? | Yes ☐ | No☐ |
| 57. Do you irrigate your green beans? | Yes ☐ | No☐ |
| 58. What is the source of your climate change information? (Multiple choice is allowed) | Government extension agent☐, Environmental NGOs☐, Farmers cooperative☐, Research institution/University☐, Farmers friends ☐, Others(specify)…… | |

How frequent do you get climate change information from the following? (Multiple choice allowed)

| Channel | Never | Rarely | Sometimes | Often | Always |
|---|---|---|---|---|---|
| 59. Radio ☐ | | | | | |
| 60. Television ☐ | | | | | |
| 61. Newspaper ☐ | | | | | |
| 62. Farmers group/coop. ☐ | | | | | |
| 63. Internet ☐ | | | | | |
| 64. Farmers colleagues ☐ | | | | | |
| 65. Govt extension agent ☐ | | | | | |
| 66. NGOs ☐ | | | | | |

Consider the following environmental events, what is your perception about them?

| Event | Strongly Disagree | Disagree | Undecided | Agree | Strongly Agree |
|---|---|---|---|---|---|
| 67. I believe there is adequate rainfall during planting season | | | | | |
| 68. I perceive there is an increase in the frequency of drought | | | | | |
| 69. I believe diseases can impact the quality of green beans | | | | | |
| 70. I feel temperature has increased in recent times | | | | | |
| 71. I believe recommended pesticides are relatively expensive | | | | | |
| 72. I believe there is decrease in rainfall duration (days) | | | | | |
| 73. I believe there is an increase in pest outbreak | | | | | |

# Annex II

## Questionnaire for key informants

The questionnaire typically consists of structured questions which allow respondents to share their thoughts and experiences in detail. The structure is highlighted below. However, insights were not limited to the following:

### Economic Issues

1. Can you describe briefly the economic challenges faced during the production of green beans
2. How easy is it to acquire loans from formal institutions
3. What are the constraints to land acquisition
4. Are there government incentives to farmers in terms of improved seeds, machinery, subsidized herbicides, fertilizer and pesticides?

### Social Issues

1. Kindly describe the model of cooperative or farmer groups (number composition, requirement for entry and election of executives)
2. Do farmers readily assist themselves on their farms or they employ paid labor
3. What is the dynamic of relationship between farmers and European Union

a) Do farmers give feedback on challenges or the EU simply expects the standards to be met

b) If they do communicate, can you list a few of the channels of dialogue

4. Can you enumerate the steps involved in getting certification

### Environmental Issues

1. What are the challenges faced in terms of climate and weather conditions
2. What do you know about Maximum Residue Limit (MRL)
3. Are there money-friendly alternatives to the recommended pesticides stipulated by the European Union?
4. What are the mitigating mechanisms currently employed to the environmental constraints faced by farmers?

## Annex III


M PESA